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A Classroom Savonius Windmill

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A CLASSROOM SAVONIUS WINDMILL

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Introduction

The Savonius or S-rotor windmill was introduced to the United States in 1924. The powershaft is located in the vertical plane rather than horizontally as in the traditional bladed Stuart windmill. This has several benefits. The windmill does not need a wind direction seeking vane since it doesn't matter from which direction the wind is blowing. Also, power is available at the base of the mill rather than at the top of the tower. The Savonius mill is also less easily damaged by high winds than the traditional windmill.

A simplified Savonius windmill may be constructed for your classroom without too much difficulty. The model is approximately 3 feet tall which makes it portable and easy to store and yet it is large enough to actually generate electricity when coupled with a small permanent magnet electric motor operated as a generator.

Materials

To construct the model, you will need the following materials:
1. 3 two-pound coffee cans or the equivalent
2. ¼ inch diameter threaded rod 3 feet long
3. 6¼ inch diameter nuts
4. 2 roller skate wheels with a ¼ inch inside diameter
5. Scrap masonite or thin plywood for end caps
6. Scrap pine lumber or plywood for the support frame
7. Epoxy cement

Obtain all of the materials before you begin construction. You may find it necessary to make substitutions in materials and/or dimensions. Plan ahead and you won't get any unexpected surprises.

Procedure

1. Cut both ends out of three coffee cans. Carefully cut the cans in half lengthwise so that you end up with two equal sized trough-shaped pieces from each can. Cover the sharp edges with adhesive tape to lessen the possibility of a cut.

2. Next fabricate the four end caps of thin plywood or masonite, ⅛″ or ¼″ thick will be adequate. The diameter of the end caps should be twice the diameter of the cans you used plus 1″. These end caps

should be round and must have a ¼″ diameter hole drilled in the exact center. Draw a straight line through the center of each end cap with a pencil to assist you in positioning the rotor blades on the end caps.

3. Assemble two can halves to an end cap in the following manner to form a rotor subassembly. Use epoxy cement mixed in accordance with the package instructions to glue the rotor blades in place (Fig. 1).

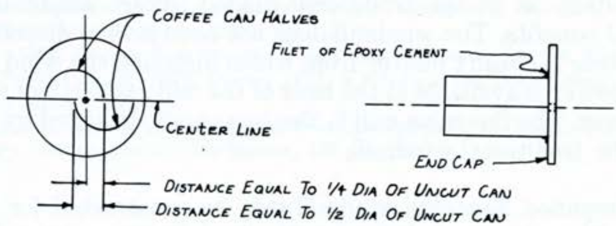

Fig. 1.

4. Make a total of three rotor subassemblies as shown in step 3.

5. Join the three rotor subassemblies and the fourth end cap as shown in Fig. 2 by passing the 3 foot threaded rod through the center hole of each end cap. Make sure that the center line of each end cap is oriented 60° away from the one below it. Epoxy each rotor subassembly and the fourth end cap to the one next to it and tighten the ¼″ nuts to hold everything together until the epoxy cement dries.

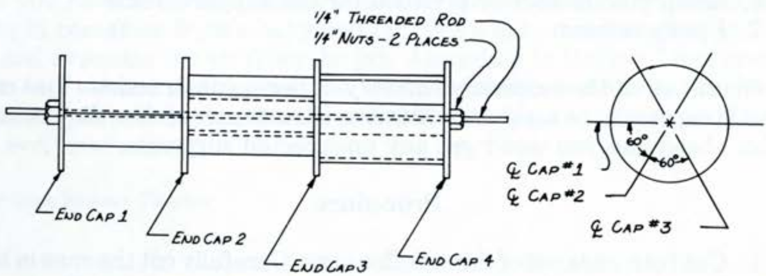

Fig. 2.

6. Install the bearings (roller skate wheels) in the following manner: Use a ¼″ nut at each end of the bearing to hold it in place and lock it to the rotor shaft. Tighten the nuts snugly (Fig. 3).

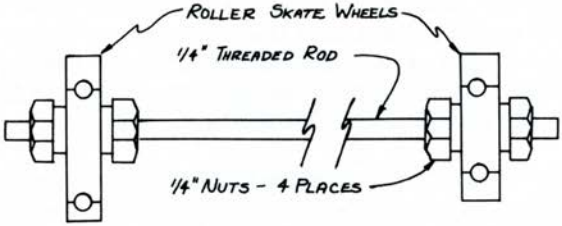

Fig. 3.

7. Balance the rotor assembly by placing it horizontally supported on its bearings (for instance, between two desks) and spin it by hand. When it stops spinning mark the very bottom of one of the end caps with chalk. Repeat this procedure several times. If you find that one side always ends up on the bottom you will have to lighten this side by removing material from the end caps. Do this gradually by filing, sanding, or scraping away the excess, carefully checking to assure that not too much material has been removed. When the rotor is correctly balanced it will stop in random positions when spun. This completes the rotor assembly.

8. Make a suitable framework that will allow you to mount the rotor in a vertical position supported by its bearings and free to turn in the wind. This framework may be constructed of scrap plywood or ¾″ lumber. A suggested configuration is shown in Fig. 4.

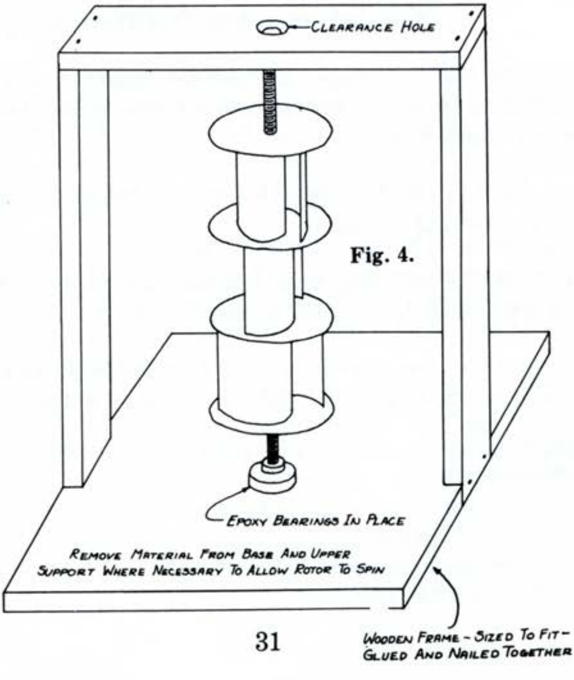

Fig. 4.

9. Epoxy the outer races (surfaces) of the bearings to the base and upper support. Make sure that the rotor is free to turn. You may have to remove some material from the base and upper support by drilling to allow clearance for the inner race of the bearing and ¼″ nuts on the end of the threaded rod.

Conclusion

Take your masterpiece outside on a breezy day and see how well it works. If you are satisfied with its performance, you may attach a small 1½ volt DC permanent magnet motor to the shaft by using pulleys and elastic band belts. When the motor is spun fast enough it will generate enough electricity to light a 1½ volt light bulb.

Further information on the Savonius windmill may be obtained by referring to the Mother Earth News magazine and other periodicals, such as *Popular Science*, *Popular Mechanics*, and *Mechanix Illustrated*. *Wind and Windspinners*, by Michael A. Hackleman and David W. House, published by Peace Press, Culver City, California, is a very comprehensive source of information on the Savonius type windmill.

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New Astronomical Discoveries

May 1, 1978, the *Astrophysical Journal* reported that M87 appeared to have a central mass concentration which could be interpreted as that of a massive black hole.

June 22, 1978, the U.S. Naval Observatory reported the discovery of a new moon orbiting Pluto.

July 1, 1978, the *Astrophysical Journal* reported the development of a new theory for the formation of galactic arms.

August 1, 1978, the *Astrophysical Journal* reported evidence that quasars possessing large red shifts must be at immense distances.

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